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NATIONAL EMISSION DATA SYSTEM AREA SOURCE INVENTORY FOR THE STATE OF IOWA

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The purpose of the Task was to complete National Emission Data System (NEDS) forms for area source emissions for each county in the state of Iowa. These forms are suitable for key punching. Input data were obtained, insofar, as possible, from the appropriate state agencies and the state's Implementation Plan. Where agency data were insuffi-cent to complete the NEDS forms, entries were determined following procedures outlined in the manual for area source coding. The NEDS area source coding form is illustrated. The procedures are detailed for completing the form and refer to specific information fields thereon.

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State implementation plan
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NATIONAL EMISSIONS DATA SYSTEM

AREA SOURCE INVENTORY

FOR THE STATE OF IOWA

1.0 INTRODUCTION

The purpose of the Task was to complete National Emission Data System (NEDS) forms for area source emissions for each county in the state of Iowa. These forms are suitable for key punching. Input data were obtained, insofar as possible, from the appropriate state agencies and the state's Implementation Plan. Where agency data were insufficient to complete the NEDS forms, entries were determined following procedures outlined in the NEDS Manual for area source coding. Section 2.0 details the exact procedures used.

Figure 1.1 shows a NEDS area source coding form. The procedures detailed in Section 2.0 follow the coding form and refer to specific information fields thereon.

NATIONAL EMISSIONS DATA SYSTEM (NEDS)
ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR PROGRAMS

AREA SOURCE
Input Form

Date _____

Name of Person Completing Form _____

State	County	AQCR
1 2	3 4 5 6	7 8 9

Year of Record	EMISSION ESTIMATES (10^2 tons) Particulate	SO_2	NO_x	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid. Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49

RESIDENTIAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gal.	Resid. Oil 10^4 Gal.	Nat. Gas 10^7 ft^3	Wood 10^2 tons	Action	cd
50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77	78 A	79 A 80 1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Nat. Gas 10^7 Ft^3	Wood 10^2 tons	Action	cd
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	78 A	79 A 80 2

INDUSTRIAL FUEL Anth. Coal 10^1 tons	Bitum. Coal 10^1 tons	Coke 10^1 tons	Dist. Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Nat. Gas 10^7 Ft^3	Wood 10^2 tons	Process Gas 10^7 ft^3	Action	cd
36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69 70 71 72 73	74 75 76 77	78 A	79 A 80 3

ON SITE INCINERATION Residential 10^1 tons	Industrial 10^2 tons	Comm. Inst. 10^2 tons	OPEN BURNING Residential 10^2 tons	Industrial 10^2 tons	Comm'l - Institl. 10^2 tons	GASOLINE FUEL Light Vehicle 10^1 Gals.	Heavy Vehicle 10^3 Gals.	Off Hiway 10^3 Gals.	DIESEL FUEL Heavy Vehicle 10^3 Gals.	Off Hiway 10^4 Gals.	Rail Locomotive 10^4 Gals.	County Population 10^3	Density Code	Action	cd
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67 68 69	70 71 72 73 74	75 76 77		78 A	79 A 80 4

AIRCRAFT Military LTO CYC 10^2	Civil LTO CYC 10^1	Commercial LTO CYC 10^1	VESSELS Anth. Coal 10^1 tons	Diesel Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Gasoline 10^3 Gals.	EVAPORATION Solvent Purchased tons/yr	Gasoline Marketed 10^5 Gals.	MEASURED VEHICLE MILES Limited Access Road 10^4 Miles	Rural Roads 10^4 Miles	Suburban Roads 10^4 Miles	Urban Roads 10^4 Miles	Action	cd
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76 77	78 A	79 A 80 5

Dirt Roads Traveled 10^3 Miles	Dirt Air Strips LTO CYCLES	Construction Land Area 10^3 Acres	Rock Handling & Storing 10^3 tons	FOREST FIRES Area - Acres	Quant. ton/acre	SLASH BURNING Area - Acres	Quant. tons/acre	FROST CONTROL Orchard Heaters 10^2	Days Fired days/yr	Structure Fires #/year	COAL REFUSE BURNING Size of Bank 10^2 $yard^3$	#/year	Action	cd
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54	55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70	78 A	79 A 80 6

COMMENTS

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 | Action 78 A | 79 A | cd 80 6

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Figure 1.1. NEDS area source coding form

2.0 AREA SOURCE METHODS

2.1 County Information

County and state identifying codes are defined by the SAROAD system. The Air Quality Control Region (AQCR) identifying numbers are taken from Appendix A, Ref. 1.

County population (Card 3, 73-76) was determined from the 1970 Census of Population, Ref. 2. Urban population from the same reference, along with the information on Page 5-3 of Ref. 1 was used to determine the population density code (Card 3, 77). All population figures were projected to 1971 based on the 1960-1970 population trend, (Ref. 2).

2.2 Emission Estimates (Card 1, 12-35)

The state implementation plan emission inventory was the source of the emission estimates. These numbers were supplied to PEDCo by the Project Officer.

2.3 Sulfur and Ash Content (Card 1, 36-49)

Average sulfur and ash content was calculated by the Iowa state agency. These values were obtained by averaging point source fuel throughout the state.

2.4 Anthracite Coal

There is no anthracite coal used in Iowa. Zeros were entered in the NEDS forms for all three source categories.

2.5 Bituminous Coal

State totals for bituminous coal were obtained from Bureau of Mines data (Ref. 3). These totals were assigned to the three source categories in the individual counties by methods outlined in Ref. 1.

2.5.1 Residential Usage (Card 1, 54-58) - All the coal burned for residential use in Iowa is bituminous.

The total state dwelling units (D.U.) heating with coal were obtained from the 1970 Census of Housing (Ref. 4). The heating requirement factor for coal is 0.0012 ton coal per dwelling unit per degree-days (Ref. 1). The average annual heating degree days were obtained from Table 2.1. Total residential usage is 106,573 tons/yr calculated as follows:

Total tons/yr residential coal = no. state D.U. using coal x state average degree days x 0.0012

The total was apportioned to counties by the number of dwelling units using coal (Ref. 4) and degree days (See Table 2.1).

$$\text{Total residential coal} \times \frac{\text{County degree days}}{\text{State average degree days}} \times \frac{\text{No. county D.U. using coal}}{\text{No. state D.U. using coal}} = \text{tons/yr/county}$$

TABLE 2.1[a] - COMPILATION OF AVERAGE

ANNUAL DEGREE-DAYS BY COUNTY

FOR THE STATE OF IOWA

COUNTY	DEGREE DAYS	COUNTY	DEGREE DAYS
Adair	6450	Grundy	7100
Adams	6300	Guthrie	6700
Allamaker	7500	Hamilton	7100
Appanoose	6000	Hancock	7500
Audubon	6700	Hardin	7100
Benton	6800	Harrison	6500
Black Hawk	7200	Henry	6000
Boone	6800	Howard	7500
Bremer	7250	Humbolt	7250
Buchanan	7200	Ida	7000
Buena Vista	7250	Iowa	6500
Butler	7250	Jackson	6750
Calhoun	7000	Jasper	6500
Carroll	6800	Jefferson	6000
Cass	6500	Johnson	6500
Cedar	6500	Jones	6800
Cerro Gordo	7500	Keokuk	6250
Cherokee	7250	Kossuth	7500
Chickasaw	7500	Lee	5950
Clarke	6250	Linn	6800
Clay	7500	Louisa	6250
Clayton	7450	Lucas	6250
Clinton	6500	Lyon	7500
Crawford	6750	Madison	6450
Dallas	6550	Mahaska	6250
Davis	5950	Marion	6300
Decatur	6200	Marshall	6800
Delaware	7200	Mills	6100
Des Moines	6000	Mitchell	7500
Dickinson	7500	Monona	6750
Dubuque	7200	Monroe	6150
Emmet	7500	Montgomery	6250
Fayette	7450	Musclatine	6350
Floyd	7500	O'Brien	7500
Franklin	7250	Osceola	7500
Fremont	5950	Page	6000
Greene	6800	Palo Alto	7500

TABLE 2.1 - COMPILATION OF AVERAGE

ANNUAL DEGREE-DAYS BY COUNTY

FOR THE STATE OF IOWA

(continued)

COUNTY	DEGREE DAYS	COUNTY	DEGREE DAYS
Plymouth	7250	Union	6300
Pocahantas	7250	Van Buren	5950
Polk	6500	Wapello	6150
Pottawattamie	6350	Warren	6400
Poweshiek	6500	Washington	6250
Ringgold	6200	Wayne	6100
Sac	7000	Webster	7100
Scott	6450	Winneshiek	7500
Sioux	7500	Woodbury	7000
Story	6800	Worth	7500
Tama	6900	Wright	7250
Taylor	6100		

2.5.2 Commercial and Institutional Usage (Card 2, 15-19) - The method described in Ref. 1 was used. Commercial and institutional usage is equal to total retail dealers sales less residential usage.

Retail dealers sales		210,000 ton/yr (Ref. 3)
Less residential bituminous		106,573 ton/yr (Sec. 2.5.2)
Commercial-institutional bituminous	=	103,427 ton/yr

This total was apportioned to counties by population (Ref. 2).

County commercial-institutional, ton/yr

$$= 103{,}426 \times \frac{\text{County population}}{\text{State population}}$$

2.5.3 Industrial Usage (Card 2, 42-47) - All industrial fuel usage in Iowa is accounted for in the point source inventory.

2.6 Distillate Oil

Data was obtained from Ref. 5 for state totals and the methods described in Ref. 1 were used to calculate county usage for each category.

2.6.1 Residential Usage (Card 1, 59-63) - The number of county dwelling units using oil was taken from Ref. 4. The heating requirement factor for distillate oil is 0.18 gallon per dwelling unit-degree day (Ref. 1, pg. 5-10). County consumption was calculated similar to the method previously used for coal, (See Sec. 2.5.1).

2.6.2. Commercial and Institutional Usage (Card 2, 20-24) - The following data were taken from Ref. 5:

Use	10^3 gal
Railroads	5,503
Vessel	798
Military	378
On-highway	165,522
Off-highway	76,608
Oil company	3,108
Total (Ref. 5)	251,917

A total of 238,220 X 10^3 gal of distillate oil was assigned to residental fuel for heating (Sec. 2.6.1.) and the Iowa state agency assigned 106,206 X 10^3 gal as point source consumption.

Total assigned consumption:

Category	10^3 gal
Ref. 5	251,917
Residential fuel	238,220
Point sources	106,206
Total	596,343
Total distillate oil (Ref.5)	598,164
Less assigned oil	596,343
Total commercial-institutional dist. oil	1,821

The 1,821,000 gal were apportioned to the counties by population.

2.6.3 Industrial Usage (Card 2, 52-56) - All industrial fuel usage in Iowa is accounted for in the point source inventory.

2.7 Residual Oil

Total state consumption was obtained from Bureau of Mines data, Ref. 5, and the methods described in Ref. 1 were followed.

2.7.1 Residential Usage (Card 1, 64-68) - No data were available to indicate any residential usage. Zero was entered for all counties.

2.7.2 Commercial and Institutional Usage (Card 2, 25-29) - The total state consumption for this category was 17,262 x 10^3 gallons (Ref. 5). From the state emission inventory, point source consumption was 35,940 x 10^3 gallons, more than the total from Ref. 5. Therefore, it was assumed that there was no commercial-institutional area source consumption and zero was entered in the NEDS forms for all counties.

2.7.3 Industrial Usage - All industrial fuel usage in Iowa is accounted for in the point source inventory.

2.8 Natural Gas

Total state consumption by type of consumer was supplied by the Iowa state agency.

Total consumption by state	$319,3 \times 10^9$ CF
Residential	$95,3 \times 10^9$ CF
Commercial & Institutional	$57,0 \times 10^9$ CF
Industrial	$142,3 \times 10^9$ CF
Other	$24,7 \times 10^9$ CF

2.8.1 Residential Usage (Card 1, 69-73) - Total state natural gas consumption is apportioned to counties using the number of dwelling units using gas and county degree days.

Residential natural gas = 95.3×10^9

$$\times \frac{\text{Co. D.U. using natural gas or LPG}}{\text{State D.U. using natural gas}}$$

$$\times \frac{\text{Co. degree days}}{\text{Avg. state degree days}}$$

2.8.2 Commercial and Institutional Usage (Card 2, 30-33) - The area source total consumption for the state was apportioned to the counties by population and degree days.

County comm. & instit. natural gas = 57×10^9

$$\times \frac{\text{Co. pop.}}{\text{State pop.}} \times \frac{\text{Co. degree days}}{\text{Avg. state degree days}}$$

2.9 Wood (Card 1, 74-77)

Residential wood usage was calculated using the method prescribed in Ref. 1.

0.0017 (Ref. 1) x County D.U. using wood

x degree days = tons/yr

There were no data available to indicate the use of wood fuel by commercial, institutional, or industrial area sources. Thus, zero was entered in the appropriate columns.

2.10 Coke and Process Gas

In the absence of data to the contrary, it was assumed that no coke or process gas could be attributed to area sources. Zeros were entered in the NEDS forms.

2.11 Solid Waste

2.11.1 On-Site Incineration - Tonnages were based on factors supplied by the state agency. These factors are as follows:

Residential	-	None
Industrial	-	3 lbs/person/day
Comm. & instit.	-	0.75 lb/person/day

2.11.2 Open Burning (Card 3, 25-42) - Open burning tonnages were based on factors supplied by the state agency. These factors are as follows:

Residential:	
Urban	2 lb/person/day
Rural	1.5 lb/person/day
Industrial	zero
Comm. & instit.	zero

2.12 Gasoline Fuel

This source category includes all gasoline-powered vehicles used both off-highway and on-highway.

2.12.1 Off-Highway Usage (Card 3, 55-59) - The quantity of off-highway gasoline used in each county was calculated by Method 1 outlined in Ref. 1, using the following factors:

Tractors	1000 gal/yr/tractor
Other	12 gal/yr/capita

The number of tractors per county was obtained from Ref. 9. It was assumed that 60 percent of all tractors are gasoline powered.

2.12.2 On-Highway Light Vehicle Usage (Card 3, 43-49) - Methods 2 and 3 of Ref. 1, based on the state gasoline sales data supplied by the state, were used. The net on-highway gasoline consumed in each county was obtained by subtracting the state total off-highway consumption from the state gasoline sales total and apportioned to counties by population. Vehicle miles of travel (VMT) were then calculated assuming an average of 12.2 miles per gallon. It was further assumed that light vehicles accounted for 89 percent of the VMT and averaged 13.6 miles per gallon.

2.12.3 On-Highway Heavy Vehicle Usage (Card 3, 65-67) - Continuing with Methods 2 and 3 of Ref. 1, the heavy vehicle gasoline usage was calculated assuming that

11 percent of the VMT are heavy vehicle miles and gasoline consumption is at the rate of 8.4 miles per gallon.

2.13 Diesel Fuel

2.13.1 Heavy Vehicle Usage (Card 3, 60-64) - Heavy vehicle miles and county diesel fuel sales were not available. State total diesel fuel sales for on-highway use was obtained from Table 14, Ref. 5, "On-Highway Diesel".

State total = 3,941,000 bbl x 42 gal/bbl

= 165,552,000 gal

Assuming diesel consumption to be proportional to population, the state total diesel sales was apportioned to the counties. County population information was obtained from Ref. 2.

2.13.2 Off-Highway Usage (Card 3, 65-67) - Using Method 1 of Ref. 1, the diesel fuel usage by farm tractors is the product of the number of tractors in the county (Ref. 7) x 1000 gallon per tractor/year. The total farm tractor population is made up of 60 percent gasoline tractors, 35 percent diesel tractors and 5 percent LPG tractors.

Total consumption of off-highway diesel fuel is 76,608,000 gal (Ref. 5). However, if 1000 gal per year were assigned to each diesel tractor in the state, con-

sumption would exceed 76,608,000 gal. Further, there was no major construction project in the state during 1971. Therefore, it is assumed that all off-highway diesel fuel is used in direct proportion to the county's tractor population (Ref. 7).

2.13.4 Rail Locomotive Usage (Card 3, 68-72) - The diesel fuel used by railroads was taken from Ref. 5. These quantities were calculated by apportioning state total usage according to the number of railroad employees in each region.

2.14 County Population

County population was projected for 1971 based on 1960-1970 trend (Ref. 2). See Sec. 2.1.

2.15 Aircraft (Card 3, 10-23)

Aircraft operations were obtained from Ref. 7, Table 41 and military operations were obtained from Ref. 7, Table 38.

2.16 Vessels (Card 4, 24-40)

There were insufficient data in "Waterborne Commerce of the United States", (Department of the Army Corps of Engineers), to calculate fuel consumption, therefore these columns were left blank.

2.17 Evaporation (Card 4, 41-51)

Solvent usage was estimated from the graduated scale based on county population recommended in Ref. 1, Table 5-2. Total solvent purchased (Card 4, 41-46) is the sum of dry cleaning and other calculated usage.

Gasoline marketed was the sum of light vehicle, heavy vehicle and off-highway consumption, (Card 3, 43-59). See Sec. 2.12.

2.18 Measured Vehicle Miles

No measured data are available for the state of Iowa. Therefore these columns were left blank.

2.19 Dirt Roads Traveled

This information was not available from any state agency. Therefore, these columns were left blank.

2.20 Dirt Air Strips

This information was obtained from Ref. 7, Tables 41, A-1, A-2, and A-3.

2.21 Construction Land Area

There were no major construction projects in the state during 1971 (Ref. State Agency). Severe soil erosion can take place due to improper agricultural tilling practices, however. It was determined that five percent of total acreage tilled was subject to severe soil erosion. Acreage tilled was obtained from Ref. 8.

2.22 Rock Handing and Storing (Card 5, 27-31)

All rock handing and storage in the state of Iowa is entered in point sources. Zeros were entered in the area source NEDS forms.

2.23 Forest Fires

Information for this category was obtained from Mr. William Ferris of the Iowa Forest Service. There were 955 acres burned throughout the state in 1971. This acreage was apportioned to those counties having forested areas.

Quantity burned was calculated using (Ref. 1), assuming type of area burned to be thinly forested or brushy.

2.24 Slash Burning (Card 5, 42-50)

Information for this category was obtained from Mr. William Ferris of the Iowa Forest Service. There were 6,544 acres of grass fires in 1971; this was apportioned to those counties having no forested areas. Quantity burned was assumed to be 2.5 tons/acre, (Ref. 1).

2.25 Frost Control

The state agency stated there isn't any frost control in Iowa. Zeros were entered in the NEDS forms.

2.26 Structure Fires (Card 5, 58-61)

It was assumed that structural fires averaged four fires per 1000 population, (Ref. 1). No other information was available for the state of Iowa.

2.27 Coal Refuse Burning

There is no coal refuse burning in Iowa. Zeros were entered in the NEDS forms.

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